

CLAIMS

What is claimed is:

1. A method of cleaning semiconductor wafers before the epitaxial deposition step comprising (A) etching silicon wafers with HF; (B) rinsing the etched wafers with ultrapure ozonated water; (C) treating the rinsed wafers with dilute SC1; (D) rinsing the treated wafers; (E) treating the wafers with dilute HF; (F) rinsing the wafers with DI water; (G) drying the wafers with nitrogen and a trace amount of IPA; wherein steps (E) through (G) are conducted in a single dryer chamber and wafers are not removed from the chamber between steps.

2. Method of claim 1 wherein the dried wafers are subsequently treated in an epitaxial reactor and baked at a temperature of 700° F or below.

3. Method of claim 1 wherein the HF in step (A) is a solution of 0.5 to 5% by weight HF in water.

4. Method of claim 1 wherein the dilute HF in step (E) is a solution of 0.05 to 0.25% by weight HF in water.

5. Method of claim 1 wherein the dilute SC1 is a solution of 0.1 to 0.5% by weight ammonium hydroxide and about 0.1 to 1 % by weight hydrogen peroxide water.

6. Method of claim 1 wherein the ozonated water in the rinse of step (B) comprises less than about 10 parts per million (ppm) ozone in water.

7. Method of claim 1 wherein the dissolved oxygen (DO2) is controlled at less than 1 part per billion (ppb).

8. Method of claim 1 wherein the total organic carbon (TOC) is less than about 1 ppb.

9. Method of claim 1 wherein the total dissolved silica is less than about 1 ppb.

10. Apparatus for pre-epitaxial cleaning of silicon wafers comprising a single tank adapted for cleaning, rinsing, and drying the wafers, the apparatus comprising means to inject HF into a DI water stream.

11. Apparatus of claim 10 wherein the tank is constructed of primarily fluoropolymer material.

12. Apparatus of claim 11 wherein the fluoropolymer is PVDF or PFA.

13. Apparatus of claim 10 wherein the means to inject HF comprises a metering pump, a reservoir, a static mixer, and a processor to control the concentration and flow of HF into the tank.

14. Apparatus of claim 10 wherein an outer weir directs cascading liquid into the module drain.

15. Apparatus of claim 10 wherein the tank has a profile that provides the optimum fluid flow field for uniform etching of dielectric films.